



To: Professor Pisano

From: Muayad Al Riyami, Ben Gross, Andrew Chen , Fatima Dantsoho, Seunghak Shin

Team: 17 (Future of Heat)

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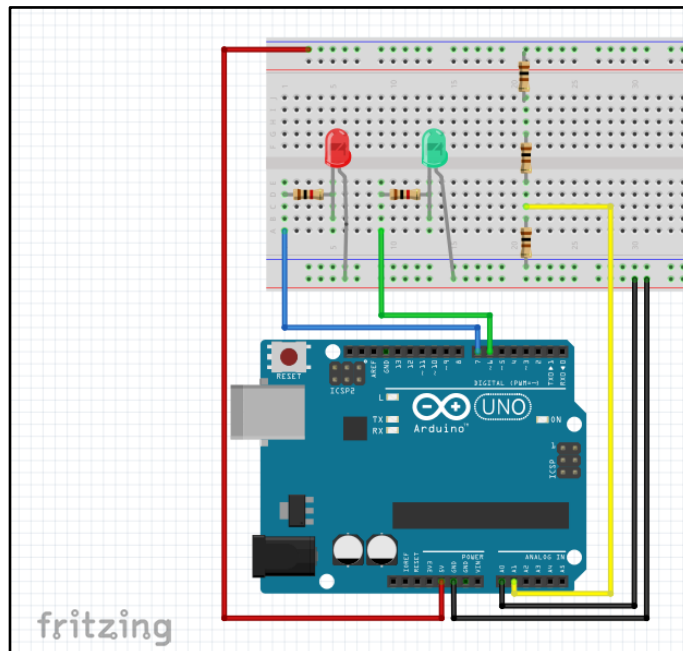
Subject: Prototype Test Report

1.0 Setup and Testing Procedure

The team is testing two parts of the project: the Arduino's circuit and the web app's user interface.

A. Arduino:

The Arduino circuit will be set up according to the following schematic, to test the accuracy of the voltage reading and power calculation.



The Arduino code will be tested on two things: If it lights the correct colored LED depending on the user input (green when the input is electric heating and red when the input is natural gas heating), and if it measures the correct voltage across the resistor and calculates the corresponding power value. The test will be repeated three times with

different resistor values each time. Once with 100 ohms, once with 200 ohms, and once with 300 ohms.

B. Web application:

The web app will be tested on the functionality of a few things. First, check that all different pages are accessible from the main page and that maneuvering from every page back to the home page is possible. Second, all user inputs are controllable with working range sliders that store values correctly. The outputs are automatically populated based on the user inputs. Third, the interactive map highlights the part that the mouse is hovering over.

Note:

- For testing purposes, a picture of the solar system is replacing the actual map as the project map is not ready yet.
- At this time, the output calculation formulas are not accurate. We are still working on it.
- The arduino and web application will be hosted on firebase.

2.0 Results

A. Arduino

The green/red LEDs worked as follows:


Input(serial monitor)	Output	
	Green	Red
'N' for natural gas	Off	On
'E' for electricity	On	Off


The Arduino circuit results were as follows:


Load Resistance	$V_{Theoretical}$	V_{Actual}	$P_{Theoretical}$	P_{Actual}	V % Error	P % Error	LEDs Correct?
100 Ω	1.6 V	1.6446 V	0.027 W	0.02778 W	1.32%	2.8%	Yes
200 Ω	3.3 V	3.328 V	0.05 W	0.05556 W	0.154%	0.46%	Yes


300 Ω	5.0 V	4.9922 V	0.083W	0.08306 W	0.156%	0.328%	Yes
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B. Web application:


HOME


INPUT



OUTPUT


MAP


CONTACT

Future Of Heat.

A Physical Grid Model Teaching Tool.



Click to Start


HOME


INPUT


OUTPUT


MAP


CONTACT

About This Project

This Future of Heat project pertains to educating children and the general public on the now emerging push towards the electrification of home heating. The conventional method for home heating, mainly utilizes furnaces, which burn fossil fuels, like natural gas, for heat. As the need to reduce carbon emissions grows ever more imminent, certain cities internationally have taken steps towards banning fossil fuel based heating to usher in the transition towards electrical heating. As such, it is important to understand the effects of this transition towards electrical heating.

User Input

Homes Using Electric Heat

Weather

Number of Electric Vehicles

50%
Homes

60°F
Weather

10%
Electric Vehicles

Enter

1.1032155000000001 t/home
Electric

6060853.9999999513t/home
Oil & Natural Gas

t/home
saved

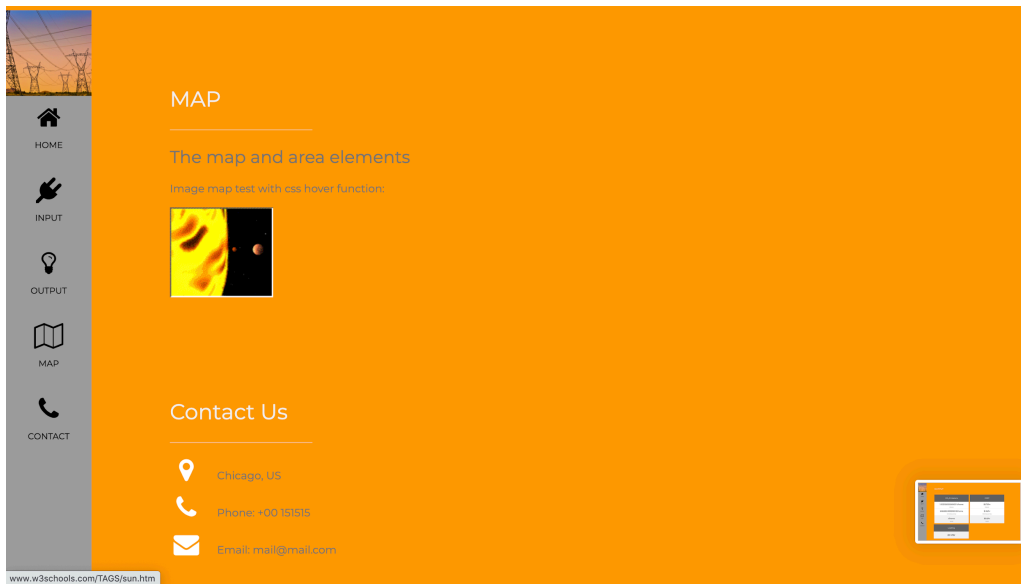
\$0.75/hr
Electric

\$1.25/hr
Oil & Natural Gas

\$0.5/hr
saved

Loading

20 MW



3.0 Conclusion

All in all, the testing was successful. We did not encounter any problems and the project components performed as expected. The Arduino lit up the correct LED that corresponded to the user input. And it measured relatively accurate voltage values and calculated the power, the percent error came mainly from the 0.00488 V resolution limit imposed by the 10 bit size when converting from analog to digital. The web application had smooth transitions between pages, and registered input values correctly using range sliders. The mock-up map worked as intended by highlighting the components when the mouse hovered over them. However, we need to reduce the precision of the output numbers to about 3-4 decimal places.